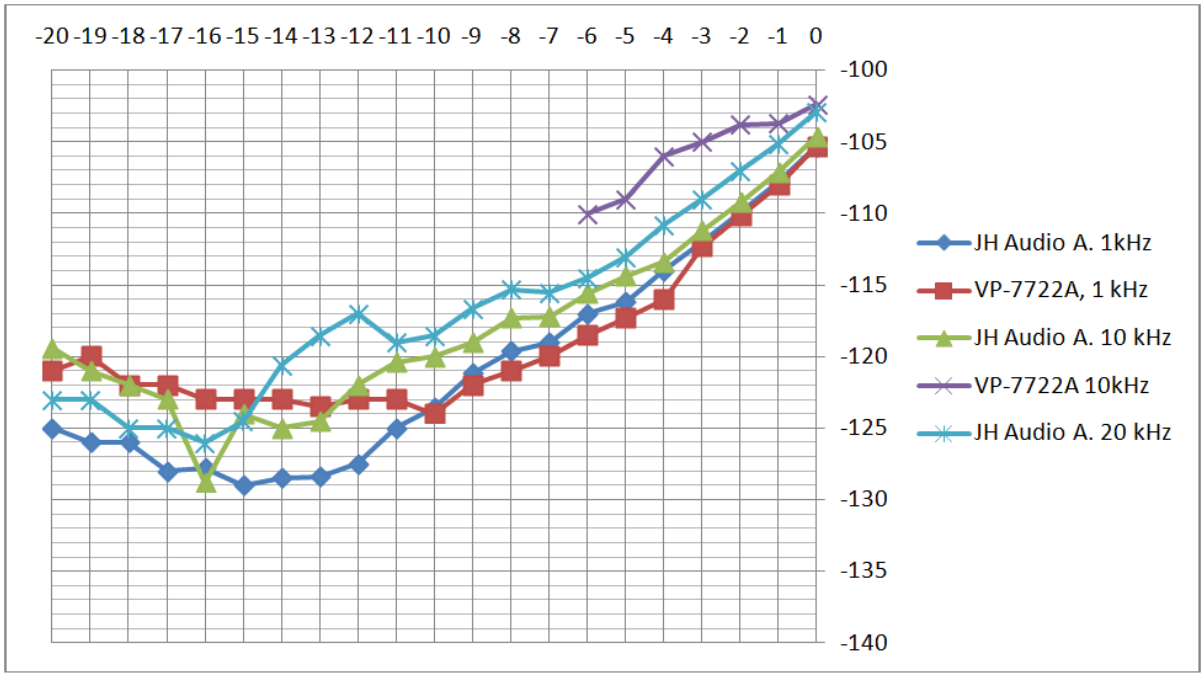
Audio Analyzer with AK4490 and AK5394A.

Measurements 151024/151025

1 Distortion

The figure below summarizes the distortion measurements, using the AK4490 based generator. The distortion was measured with the AK5394A based input and with a Panasonic VP-7722A Audio Analyzer. The connection between the generator and the analyzer was balanced for the AK5394A channels and single ended for the VP-7722A.
When measuring with my Audio Analyzer I used different attenuator settings in an attempt to avoid distortion from the ADC influencing the measurements of the DAC.



Generator distortion with AK4490. 151024. X-axis = dBFS, Y-axis = THD in dB.

At 1 kHz there is a fairly good agreement between the two analyzers between 0dBFS and -10dBFS. Below -10dBFS out it seems like the VP-7722A hits a noise floor of some sort.

At 10kHz there is a larger difference and I could not get reliable results below -6dBFS (2.5Vrms single ended) out.

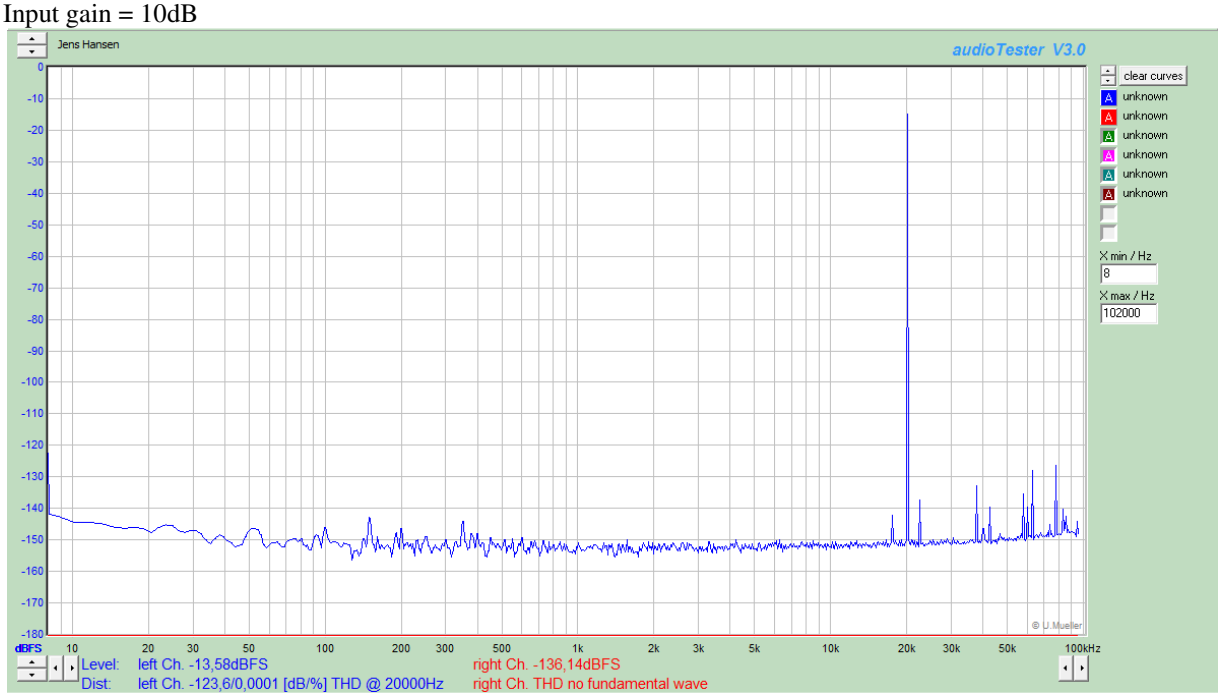
At 20kHz I could not get reliable results at all with the VP-7722A.

The figures below shows some examples of the measurements using my Audio Analyzer.

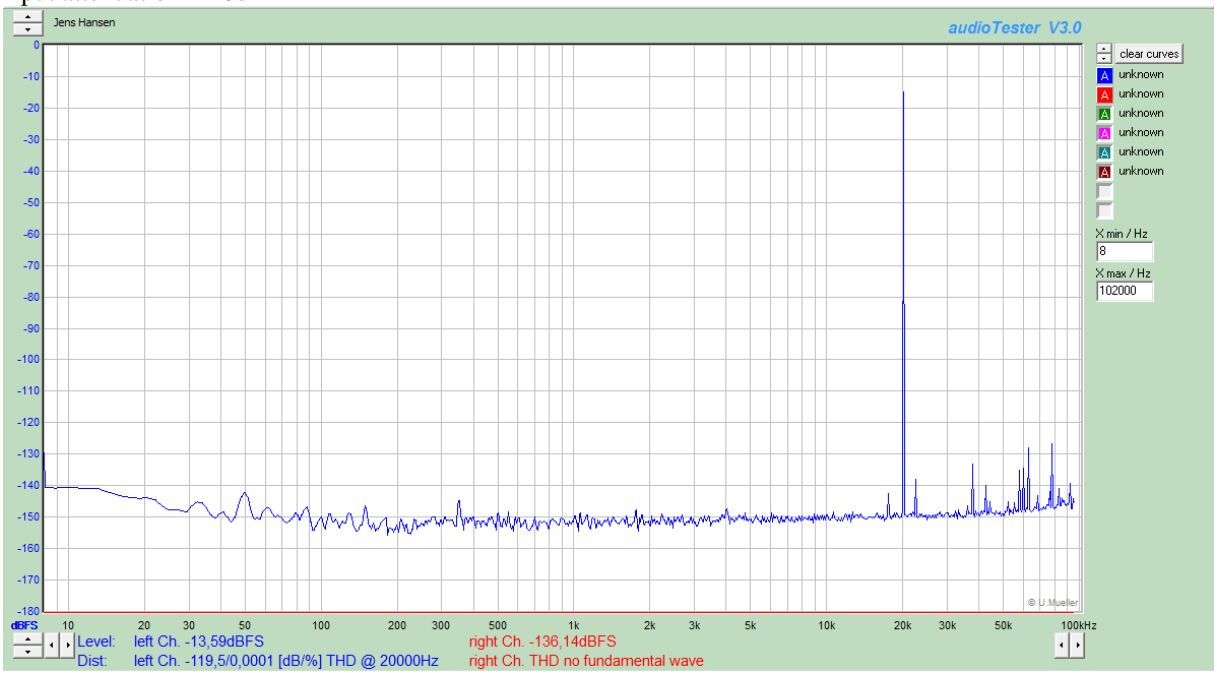
Apart from some harmonic distortion there seems to be some mirror products as well.

Distortion at 20 kHz with different output and input settings.

Output level = -14dBFS
Output attenuation = 20 dB
Input gain = 10dB

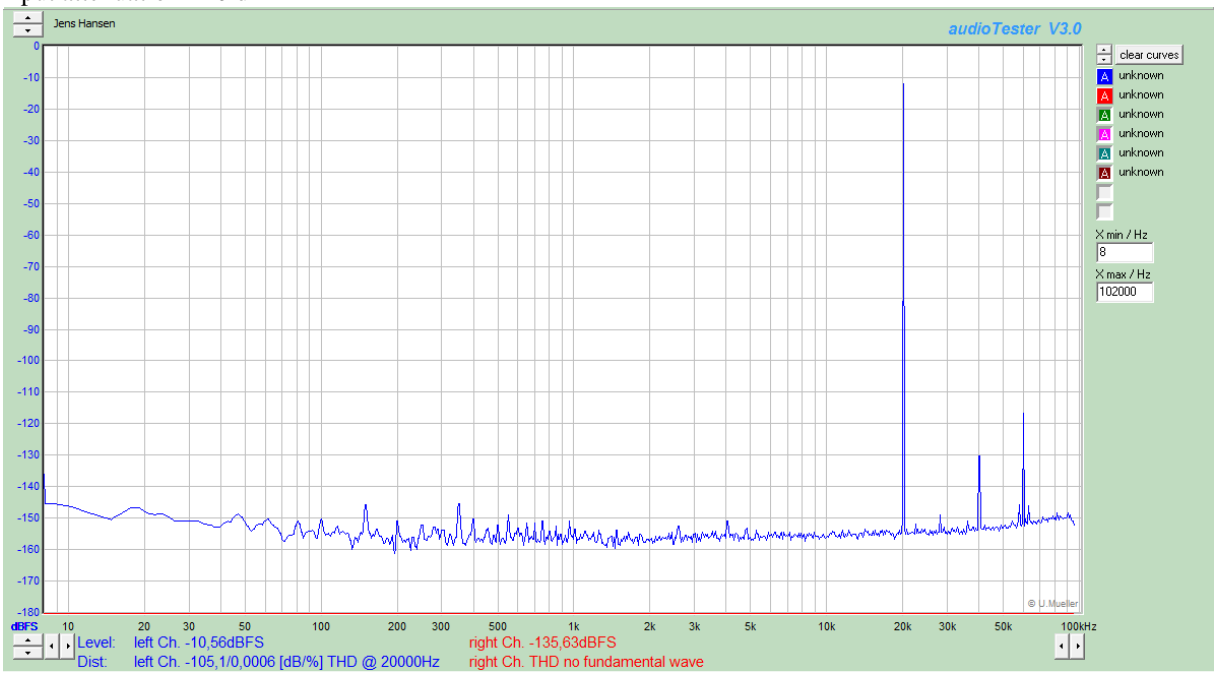


Output level = -14dBFS
Output attenuation = 0 dB
Input attenuation = 10dB

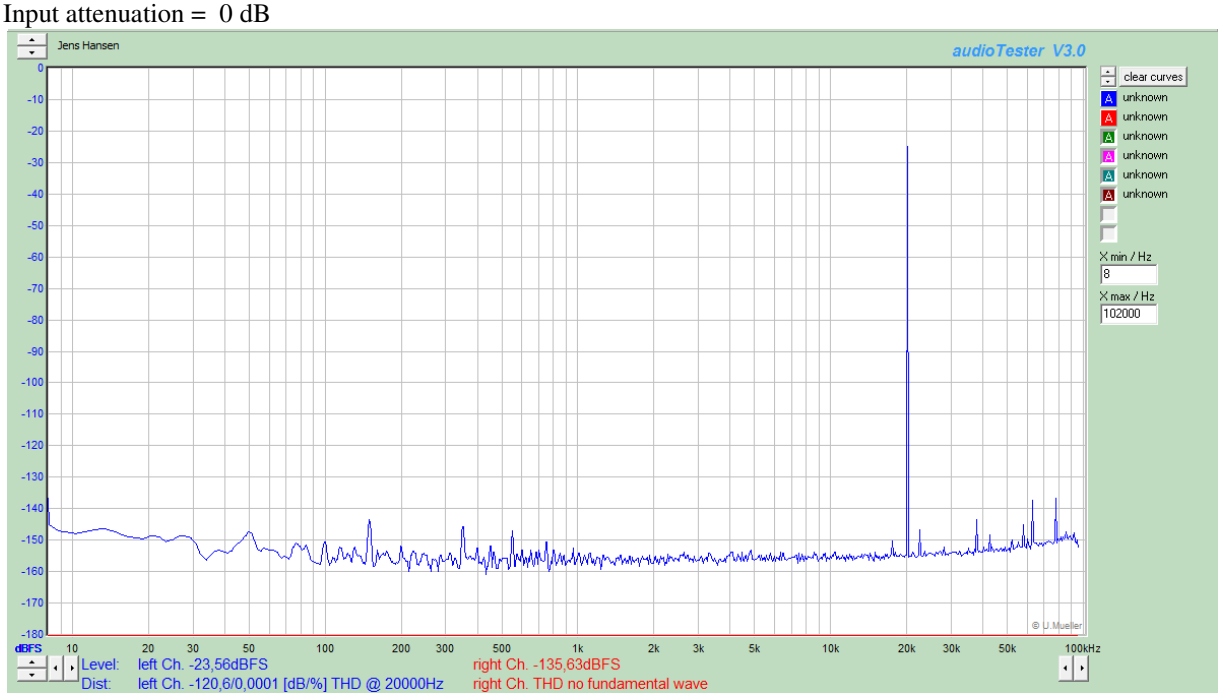


The distortion is slightly higher in this case.

Output level = -1dBFS
Output attenuation = 20 dB
Input attenuation = 0 dB



Output level = -14dBFS
Output attenuation = 20 dB
Input attenuation = 0 dB



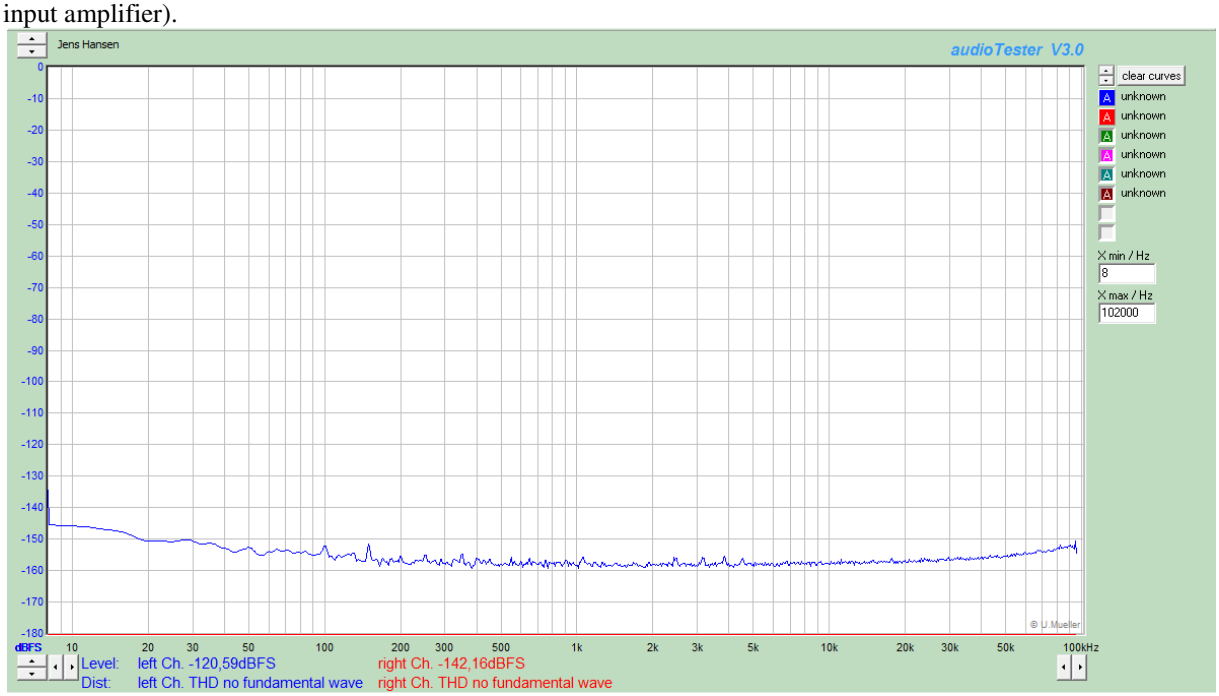
2 Noise

2.1 Idle noise with shorted input

The RMS values are calculated from 20Hz to 20kHz. Lamps (in protection circuit) replaced by 150ohm resistors.

2.1.1 3V range

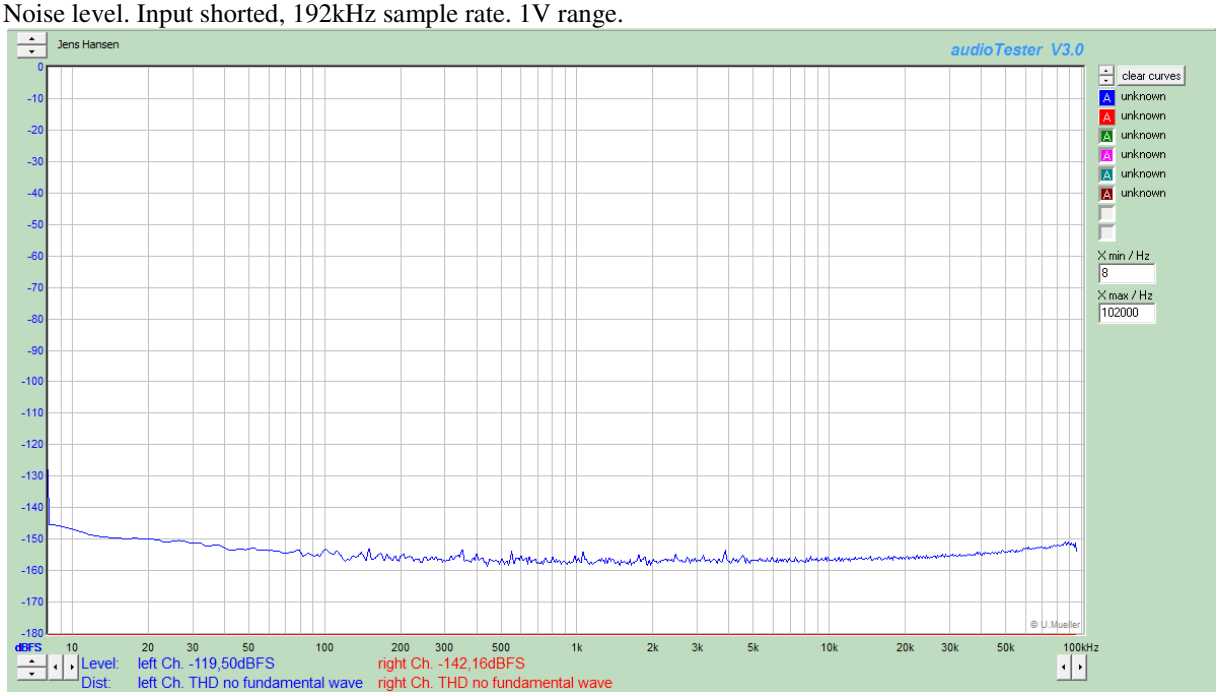
Noise level. Input shorted, 192kHz sample rate. 3V range (no attenuation in the input stage, minimum gain in the input amplifier).



Noise over a 20kHz bandwidth = -120.59dBFS

2.1.2 1V range

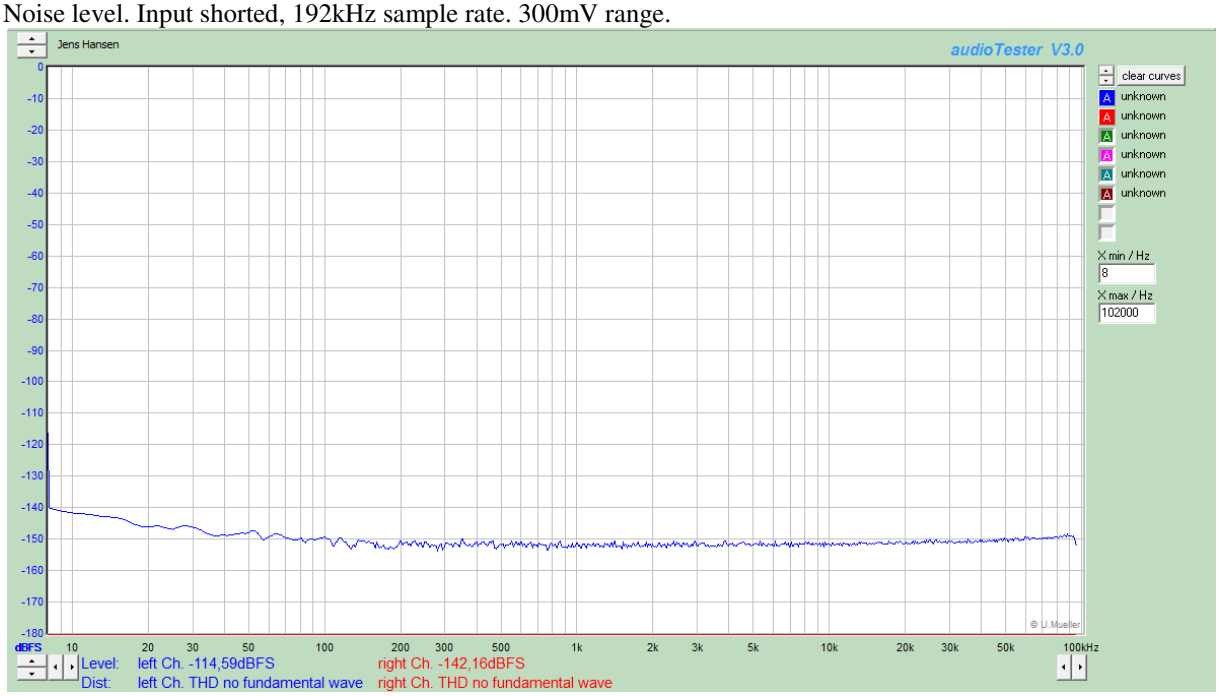
Noise level. Input shorted, 192kHz sample rate. 1V range.



Noise over a 20kHz bandwidth = -119.50dBFS

2.1.3 300mV range

Noise level. Input shorted, 192kHz sample rate. 300mV range.



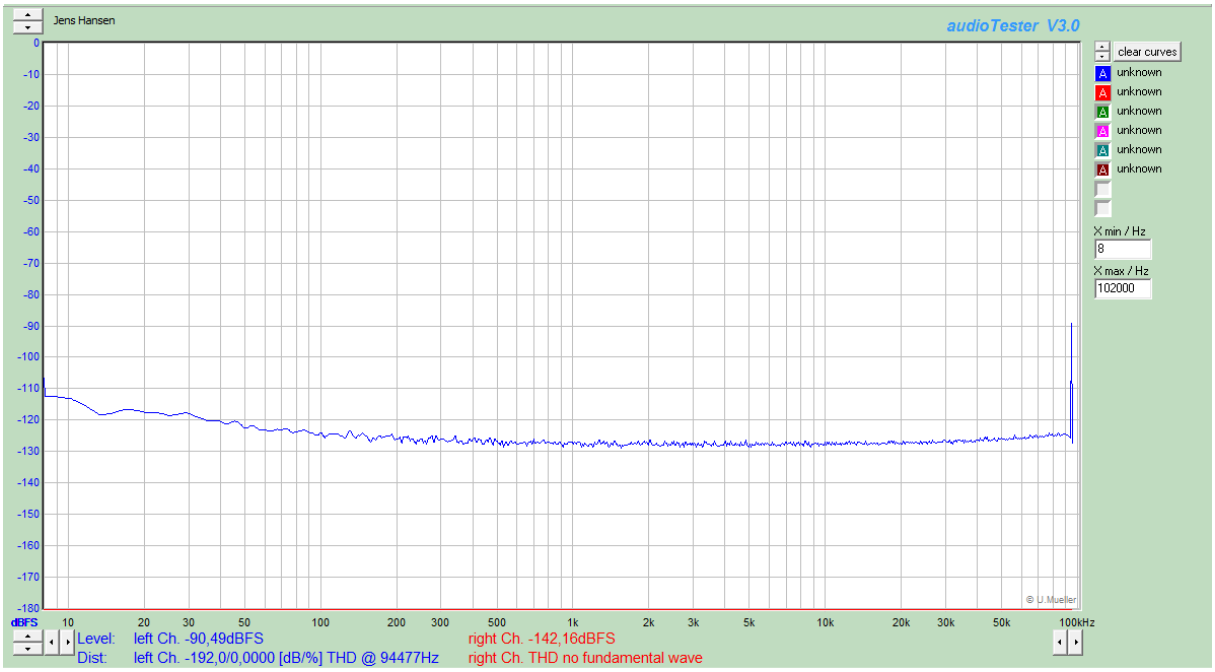
Noise over a 20kHz bandwidth = -114.59dBFS

This is equivalent to an input noise of 0.6uV in a 20kHz bandwidth. Or 4.2nV/rtHz.

2.2 Generator noise

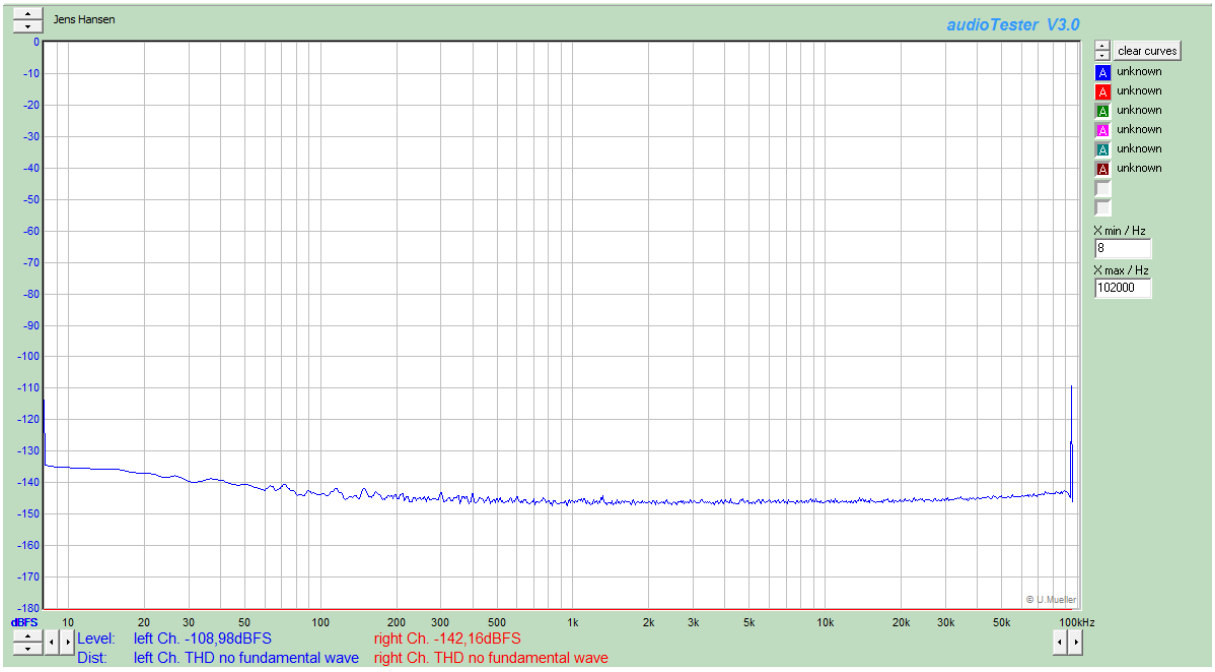
The noise was measured with the AK5394A based channel in the 300mV input range.
The RMS values are calculated from 20Hz to 20kHz.

2.2.1 10V output range



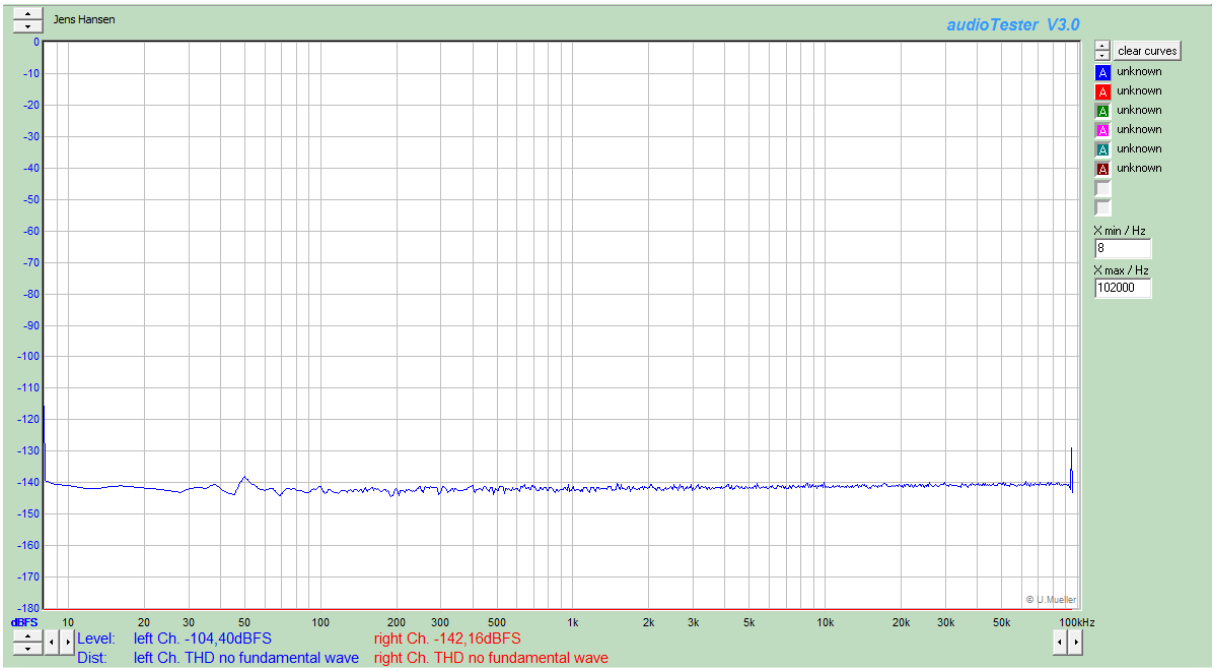
Noise over a 20kHz bandwidth = -90.49dBFS on the input. This corresponds to a level of -120.48dBFS on the generator = 9.5uVrms.
There is a noise peak at 94.777kHz. Probably from the DAC.

2.2.2 1V output range



Noise over a 20kHz bandwidth = -108.98dBFS on the input. This corresponds to a level of -118.98dBFS on the generator = 3.6uVrms.

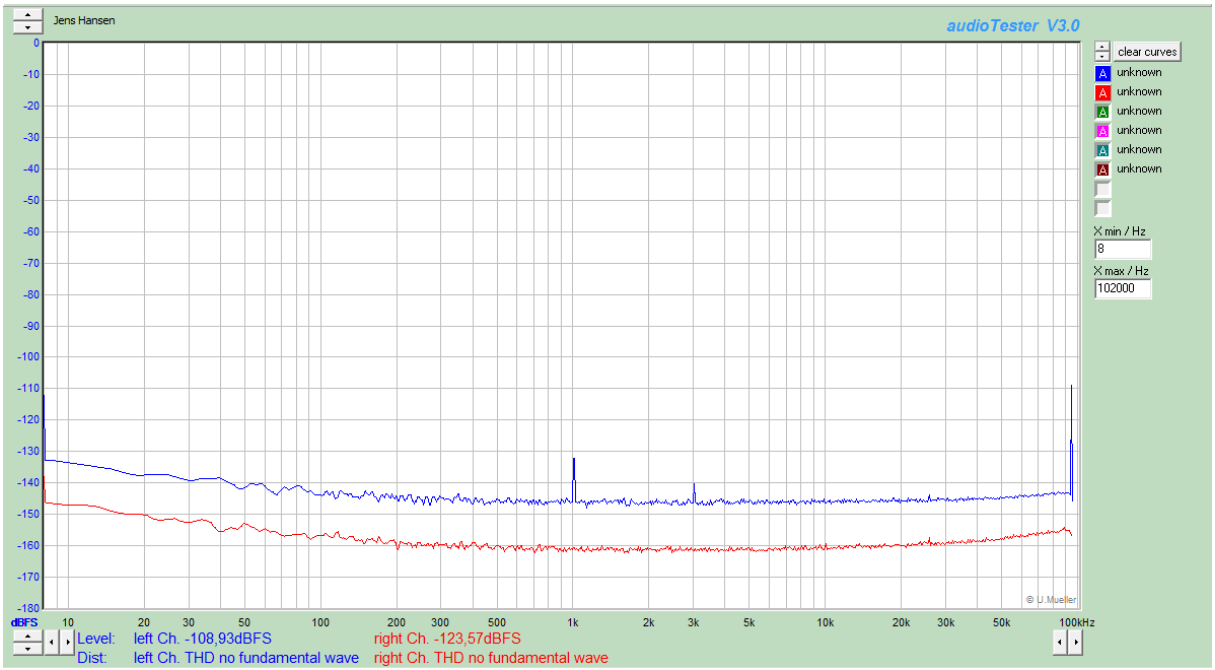
2.2.3 100mV output range



Noise over a 20kHz bandwidth = -104.40dBFS on the input. This corresponds to a level of -128.98dBFS on the generator = 0.6uVrms.

2.2.4 Check with signal

The measurements of the generator noise shown above were made with no signal output. To verify that this does not give an advantage in the form of a built-in mute function in the DAC, the figure below shows a measurement at the 1V output level and a signal level of -150dBFS. This corresponds to a single LSB toggling with a 24 bit signal, so effectively a square wave output.



Noise over a 20kHz bandwidth = -108.93dBFS on the input. The measurement without any signal showed -108.98dBFS, so the result has not really changed. Verifying that the DAC does not "cheat" in the noise measurements.